भारतीय मानक
Indian Standard

IS 14606 : 2022

सिंचाई उपस्कर — दानेदार मीडिया फिल्टर — विशिष्टि

(पहला पुनरीक्षण)

Irrigation Equipment — Granulated Media Filters — Specification

(First Revision)

ICS 65.060.35

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Farm Irrigation and Drainage Systems Sectional Committee, FAD 17

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Farm Irrigation and Drainage Systems Sectional Committee had been approved by the Food and Agriculture Division Council.

A Sand and Gravel filter (hereinafter called media filter) is basically a tank filled with sand or Gravel of appropriate size and grade. Media filters are especially suitable for micro irrigation systems because they are three dimensional filters. Media filters are often used with Emitting pipe systems and with emitter (dripper) systems, particularly where the water is from a surface source such as stream or reservoir.

This standard was first published in 1998. The first revision has been taken up to keep pace with the latest technological developments and international practices.

In the preparation of this standard, considerable assistance has been derived from the following standards:

ISO/FDIS 9912-4	Agricultural irrigation equipment — Filters for micro irrigation — Part 4: Granulated media filters

The composition of the Committee, responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

IRRIGATION EQUIPMENT — GRANULATED MEDIA FILTERS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard deals with manual and automatic backflow media filters and applies to:

a) manually cleaning filters.
b) complete automatic filters at a single unit level.
c) a filtration battery which is a complete filter system that includes:
  1) Inlet — Unfiltered supply water;
  2) Outlet — Filtered water carried to the irrigation network; and
  3) Back flush outlet — This is for the water and filtrate, flushed out during the backflow procedure.
d) Command power source — Usually hydraulic-filtered water for automatic operation (can also be pneumatic or electric).

1.2 This standard specifies the construction requirements and test methods for "granulated media filters", hereinafter called media filters, intended for operation in agricultural irrigation systems. It includes manual cleaning media filters and automatic self-cleaning media filter "batteries" (2 units or more working in parallel).

1.3 This standard deals with the operation and performance of a media filter including related valves, backwash mechanism, under-drains, manifolds and all related accessories necessary for the operation of the filter.

1.4 This standard deals only with pressurized filters operating in a range of filtration velocities declared by the manufacturer. The standard does not deal with filtration ability, efficiency and capacity (quality of filtered water, time of operation before media filter becomes entirely clogged, etc).

2 REFERENCES

2.1 The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. In case the standards are to be referred in this clause they are to be listed as follows:

IS No.	*Title*
2 : 1960	Rules for rounding off numerical values (*revised*)
554 : 1999/ ISO 7-1	Pipe threads where pressure — Tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
6418 : 1971	Cast iron and malleable cast iron flanges for general engineering purposes
2405 (Part 1) : 1980	Industrial sieves: Part 1 Wire cloth sieves
2405 (Part 2) : 1980	Industrial sieves: Part 2 Perforated plates
10483 : 1983/ ISO/DIS 7806	Code for designating perforations of industrial plate sieves
12785 : 1994	Irrigation equipment — Strainer-type — Filters

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

3.1 Granulated Media Filter — A filtration device that uses a bed of media to remove organic and inorganic particles from the incoming irrigation water. Each media filter is contained within a pressure vessel(s) or tank(s) having service openings, inlet, outlet and backflush connections that contains underlying drains (for example, PVC plastic, stainless steel, or ceramic materials) with or without a gravel bed to facilitate the backwashing procedure. Media filter is sometimes referred to as a depth filter.

3.2 Filtration Media — The filtration material used in a media filter. The media generally consists of crushed granite, silica, or quartz sieved to specific particle sizes. Media may also consist of many other materials such as cardboard or synthetic fibres, woven textiles of various type or synthetic particles.

3.3 Clogged Filter Media — A filter which has collected a quantity of solid contaminates, such that it cannot maintain the highest flow rate recommended by the manufacturer without exceeding the safe maximum pressure drop.

3.4 Flush Valve — A valve through which the back flushing to the atmosphere is performed, normally closed in the filtering stage and opened during back flushing.

3.5 Nominal Pressure — Maximum static water pressure immediately upstream of the filter inlet at which the filter is required to operate.

3.6 Clean Pressure Drop — Pressure drop in a clean filter measured with a flow of clean water.

3.7 Safe Maximum Pressure Drop — Maximum allowable difference, declared by the manufacturer, between inlet and outlet pressures across the filter when the filter element has become clogged to the extent of requiring cleaning or replacement.

3.8 Range of Recommended Flow Rates — Flow-rates declared by the manufacturer for proper operation of the filter.

3.9 Nominal Size — Conventional numerical designation expressed in mm (or inches) to indicate the nominal diameter of the inlet connections.

4 CLASSIFICATION

Granulated media filters are classified as given below:

4.1 Flow Direction

4.1.1 From top to bottom. Back flushing in reverse direction.

4.1.2 From bottom to top. Back flushing in any direction.

4.2 Type and Number of Different Media Layers

4.2.1 Single layer (including inner support layer, if existing).

4.2.2 Multilayer, provided layer stratification can be resumed after back flushing.

4.3 Mechanical Structure and Shape (for Clarification Purposes Only)

4.3.1 *Cylinder*

4.3.2 *Oval/Ball/Spherical*

4.3.3 *Other Pressure Sustaining Shapes*

4.3.4 *With Pipe Collection Underdrain System*

4.3.5 *With Separate Chamber Collection System*

4.4 Velocity of Filtration (through the Filter) Expressed in $m^3/h\text{-}m^2$

4.4.1 Relatively slow flow, 36-49 $m^3/h\text{-}m^2$

4.4.2 Medium flow, 50-85 $m^3/h\text{-}m^2$

4.4.3 High velocity, above 85 $m^3/h\text{-}m^2$

5 TECHNICAL CHARACTERISTICS

5.1 General

The filter parts that are in contact with water shall be made of non-toxic materials, and shall be resistant to or protected against degradation caused by existing working conditions and types of water used in agricultural irrigation. The filter housing shall also be resistant to environmental conditions. Components belonging to filters of the same size, type and model, and produced by the same manufacturer, shall be interchangeable. Plastics parts of the filter that are exposed to ultra-violet radiation under the normal working conditions in which the filter operates shall include additives to improve their resistance to UV radiation. Plastics parts that enclose waterways shall be opaque or shall be provided with an opaque cover designed to block all light from reaching clear waterway enclosures. When made of mild steel, the inside of the vessel shall be suitably powder coated, not dip galvanized or painted with rubberized paint. The construction of the filter shall be such as to facilitate its proper installation in its intended location and position.

5.2 Inlet and Expansion Space Chamber

This chamber shall contain a cover to enable media filling and visual inspection. This chamber shall be designed to accommodate expansion of the media during back flushing:

a) For filter tanks larger than 914 mm, a hydraulic inlet distributor is recommended. It should evenly distribute incoming flow across media surface.
b) Expansion volume should be at least 1/3 of the media volume.
c) All filter covers operating under pressure shall be supplied with a safety mechanism to protect the operator in case of failure.

5.3 Media (main filtering) Compartment

Total volume, surface area, and depth of filtering layer shall be informed by the manufacturer:

a) Parameters pertaining to specific granular media shall be supplied by the manufacturer (or filter media provider).
b) If a rough media support layer is applied, it should be deducted from the active media parameters.
c) If the filter tank is other than a cylinder, the surface area as a function of media level, shall be indicated in the manufacturer’s catalog.

In case there is an underdrain plate, this compartment shall have a large access port to enable media replacement, testing, and servicing.

5.4 Underdrain (Collection) and Back Flush Unit

This component collects the filtered water, while not allowing media leakage. It distributes reverse water flow used for back flushing in the back flushing stage. Generally, there are two major configurations:

a) A "mushroom" system assembled on a "spider web" collection piping; and
b) A "mushroom" system mounted on top of a plate which separates the filtering compartment from the collection chamber-"underdrain plate".

The maximum size of the mushroom openings shall be no more than half of the smallest media grains diameter. Mushroom placement shall ensure even distribution of back flushing water over all the granular media surface area.

5.5 Connections

5.5.1 In filters with threaded ends for direct connection to the supply line the threads shall comply with IS 554.

5.5.2 Flanged connections shall comply either with IS 6418.

5.5.3 Flanged connections shall comply with dimensions mentioned in Table 1.

5.5.4 The backwash outlet shall be provided with a suitable end connection for the removal of the drained effluent from the site of the media filter.

6 MECHANICAL TESTS

6.1 General

Tests shall be performed with water at a temperature of 20 to 30 °C except for test in **6.3** where the water temperature shall be 60 ± 2 °C the instruments used for measuring the various parameters shall permit measurement to an accuracy of within ± 2 percent of the actual values.

6.2 Resistance of Filter to Internal Hydrostatic Pressure

6.2.1 *Preparation*

Perform this test on the filter with all its parts assembled for normal operation. Close the filter housing cover according to the manufacturer's instructions. Measure the force or moment required to do so. Before conducting the test on filters equipped with a drain valve, open and close the valve 100 times while applying a water pressure at the valve inlet equal to the nominal

Table 1 Dimensions of Flanges

(*Clause* 5.5.3)

Nominal O.D. of pipe/ID of Flange		O.D. of Flange		P.C.D. of Flange		No. of Bolt	Diameter of Bolt		Thickness of Flange	
inch	mm	inch	mm	inch	mm	No.	inch	mm	inch	mm
0.5	21.80	3.75	92.25	2-5/8	66.67	4	1/2	12.70	3/16	4.76
0.75	27.30	4.00	101.60	2-7/8	73.02	4	1/2	12.70	3/16	4.76
1	34.20	4.50	114.30	3-1/4	82.55	4	1/2	12.70	3/16	4.76
1.25	42.90	4.75	120.70	3-7/16	87.31	4	1/2	12.70	1/4	6.35
1.5	48.80	5.25	133.40	3-7/8	98.42	4	1/2	12.70	1/4	6.35
2	60.80	6.00	152.40	4-1/2	114.30	4	5/8	15.87	5/16	7.94
2.5	76.60	6.50	165.10	5	127.00	4	5/8	15.87	5/16	7.94
3	89.50	7.25	184.20	5-3/4	146.05	4	5/8	15.87	3/8	9.52
4	115.0	8.50	215.90	7	177.80	4	5/8	15.87	3/8	9.52
5	140.80	10.00	254.00	8-1/4	209.55	8	5/8	15.87	1/2	12.70
6	166.50	11.00	279.40	9-1/4	234.95	8	5/8	15.87	1/2	12.70
8	219.07	13.25	336.40	11-1/2	292.10	8	5/8	15.87	1/2	12.70
10	273.10	16.00	406.40	14	355.60	8	3/4	19.05	5/8	15.87
12	323.80	18.00	457.20	16	406.40	12	3/4	19.05	5/8	15.87
14	381.00	20.75	527.10	18-1/2	469.90	12	7/8	22.22	3/4	19.05
16	431.80	22.75	577.90	20-1/2	520.70	12	7/8	22.22	3/4	19.05
18	482.60	25.25	641.40	23	584.20	12	7/8	22.22	7/8	22.22
20	533.40	27.75	704.90	25-1/4	641.35	16	7/8	22.22	1	25.40
24	635.00	32.50	825.50	29-3/4	755.65	16	1	25.40	1 1/18	28.57

operating pressure multiplied by 0.75. Close the filter outlet by suitable means. Apply a hydraulic pressure at the filter inlet and check that no air remains trapped in the system and that the water reaches all places that may be under pressure during filter operation.

6.2.2 *Metal Filter Housing (Tank)*

Raise the pressure gradually to the declared nominal pressure multiplied by 1.5, and maintain this pressure for at least 5 min. The filter shall withstand the test pressure without suffering damage or permanent deformation. If the seal of the housing cover swells or is dislodged, apply the pressure for an additional 15 min and recheck for leakages. No signs of leakage shall appear through the filter housing, the filter housing cover seal or the drain valve.

6.2.3 *Plastics Filter Housing*

6.2.3.1 *Plastics moulded material of filter housing*

The pressure test shall be performed on an injection-moulded tube specimen made of the same material as the plastic moulded body. The dimensions of the specimen shall be as shown in Fig. 1. The wall thickness of the test sample shall not be less than that fitting a PN6 pipe and not greater than for a PN12.5 pipe for the same diameter dimension and the same diameter. The specimen shall be tested in accordance with Annex A and shall meet the strength requirements specified in Table 2. The specimen tested shall not suffer fracture or other damage.

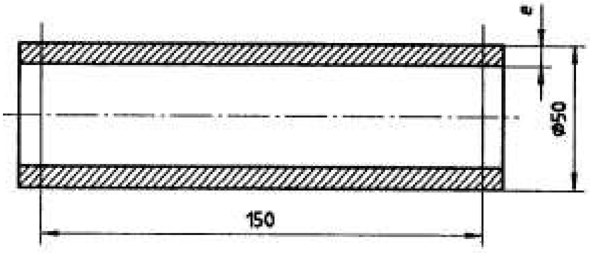

FIG. 1 FREE TEST LENGTH

6.2.4 The filter shall withstand the test without showing any signs of leakage. After completing the test, disassemble the filter and check the parts for damage. The parts of the filter shall show no signs of damage or permanent deformation.

6.3 Resistance of Filter to Internal Hydrostatic Pressure at High Temperature

6.3.1 Proceed as described in **6.2.1** but fill the tank (vessel) with water at 60 ± 2 °C and raise the internal pressure. Maintain the pressure and temperature for 15 min. The filter shall withstand the test without showing any sign of leakage.

6.3.2 After completing the test, disassemble the filter and check the parts for damage.

6.3.2.1 The parts of the filter shall show no signs of damage or deformation.

7 RESISTANCE TO CYCLIC PRESSURE

The pressure at that filter inlet shall be increased from atmospheric pressure to the maximum working pressure followed by reducing it to atmospheric pressure and continued for 1 000 cycles. The duration of each pulse shall be five minutes. Raising pressure shall take one minute. Holding pressure time is three minutes. Declining pressure down to atmospheric pressure in one minute. There shall not be any leaks or defects in the filter parts.

8 HYDRAULIC PARAMETERS AND TESTS

8.1 General

Filter media used for the clean pressure drop shall be recommended by the manufacturer. It should be of the most commonly used grades, not being extremely fine or coarse grades.

8.1.1 *Clean Pressure Drop (Pressure Loss)*

Backwash initiation (if necessary) and optimal cycle duration criteria shall follow manufacturer's

Table 2 Test Conditions and Requirements

(*Clause* 6.2.3.1)

Material	Temperature °C	Circumferential Stress N/mm²	Minimum Duration h
PVC-U	60	10	1,000
HDPE, Type I	80	3	170
HDPE, Type II	80	4	170
PP, Type I	95	3.5	1,000
PP, Type II	95	2.5	1,000
POM	60	10	1,000
ABS	70	4	1,000
PA6 (GF reinforced)	70	4	1,000

recommended operating procedures. The specific criteria used for each test period and general test conditions shall be reported. The pressure loss vs. flow tests shall be conducted with newly installed, backwashed media.

8.1.2 *Test Period*

The duration (time) for testing each pressure-flow combination depends on the time required for the entire system to reach conditions of hydraulic equilibrium. These conditions will normally occur after about 20 to 30 min as determined by monitoring pressure and flow fluctuations.

8.1.3 Pre-screen the water used for testing pressure loss in clean filter media by passing the water through a filter element with an aperture size at least 50 percent smaller than the common declared filtration capability of filters being tested. This pre-screening will avoid or reduce the need to back flush the filter during a single complete flow test run. The measured pressure drop shall not be more than 10 prcent greater than the pressure drop declared by the manufacturer.

8.2 Flows, Pressure and Test Sequence

8.3.1 *Flows*

Tests shall be conducted at the following flow-rates:

a) The manufacturer's minimum recommended operating flow per unit;

b) 0.4 Q_{max};

c) 0.7 Q_{max};

d) Maximum recommended operating flow per unit; and

e) 1.2 times the manufacturer's maximum recommended operating flow. All flows tested shall be reported.

8.3.2 *Inlet and Outlet Pressures*

Inlet pressures shall be maintained at the manufacturer's maximum recommended operating levels. Inlet and outlet pressures shall be reported at each flow, once equilibrium conditions have been established.

8.3.3 *Testing Sequence*

Tests shall proceed from the lowest to the highest flow. Backwash, if necessary, to maintain the manufacturer's recommended post-backwash pressure differentials.

9 BACK FLUSHING HYDRAULIC PARAMETERS AND TESTS

9.1 Test for Flushing Mechanism

Prior to conducting this test, flush the media in accordance with the media manufacturer's instructions (for normal field operating conditions). Connect the filter as described in the manufacturers' instructions to a test assembly to simulate field installation. The test assembly shall be capable of supplying at least twice the maximum flushing volume and maximum flow rate as declared by the manufacturer at the nominal pressure. Attach a collecting vessel to the flushing opening of the filter (flush collecting manifold) for collection of the flush water. Set the pressure at the filter inlet to the minimum working pressure and perform the flushing cycle manually. Measure the time from the moment the flush valve begins to open to the time it shuts. Repeat the test 3 consecutive times for each flow at minimum back flush flow rate and at maximum back flush flow rate recommended. Test results will be the average of all six tests.

The following requirements shall be met:

a) The flushing mechanism shall operate satisfactorily.

b) The volume of water measured shall not exceed the volume of flushing water declared by the manufacturer by more than ± 7 percent.

c) The duration of flushing measured shall not deviate from the flushing duration declared by the manufacturer by more than 15 percent.

9.2 Detecting Media Escape

9.2.1 A large volume appropriate fine screen should be installed at the back flushing outlet free flow port.

9.2.2 All media that has escaped during each single test run should be collected, dried and weighed separately.

9.2.3 *Media Escape Results*

Operate the flushing cycle for three times at the maximum recommended flow rate. The total escaping media (combined from all tests) should not exceed 0.05 % (1: 2,000) of media in the filter. In the three flushing cycles there shall be a rapid decline of media escaping in each consecutive test (with the same back flushing flow and pressure). The separate weighing should show such decline.

9.2.4 After test completion, perform visual inspection of particle media.

Upon completion of each set of backwash tests, as stated above, the granular media shall be visually inspected for the appearance of ''dishing'', depressions, uneven upper surface media, channelling, tunnelling, or other factors that may reduce the filtration effectiveness. The existence, nature, depths, and sizes of these occurrences shall be described, recorded, and reported.

10 AUTOMATIC BACK FLUSHING AND CONTROLLER

10.1 Backwash Initiation

Initiation of individual backwash operations for a filter system shall be in accordance with the manufacturer's criteria with respect to:

a) Specified timing (for example, 3 h) between backwash events.

b) Achieving a specified pressure drop across the filter system.

c) Both timing and pressure drop.

d) By volume of filtered water.

The construction of an automatic self-cleaning filter shall comply with the following specific requirements:

1) When the flushing control mechanism is included as part of the filter package, it shall be installed and tested together with the filter.

2) The filter control mechanism shall permit manual flushing at any time, irrespective of the conditions that apply to automatic flushing.

3) The construction of the filter shall allow for manual operation in the event of failure of the automatic flushing control mechanism.

4) The coordination of the cleaning operation and the opening of the flushing valve shall prevent water flowing out of the flushing valve unless the filter is being cleaned. However, an overlap of 5 percent + 5 s of the flushing time is permitted where these two valves are open/close at the same time.

5) The filter shall be equipped with a protective mechanism that prevents repeated flushing or notifies of repeated flushing. The mechanism may include the possibility of cancelling this operation.

6) In addition to the above construction features it is also recommended that the filter shall be fitted with a device to enable adjustment of the pre-set value of the filter flushing control mechanism for activation of the flushing control mechanism and for control of the duration of the automatic flushing cycle of the filter.

10.2 Flushing Control Mechanism Testing

10.2.1 *Mechanism Activated by Pressure Differential Sensor*

Disconnect the "low" pressure connection of the differential valve and connect it to an external pressure source. Leave the "high" pressure connection as connected for regular filter operation. Apply a pressure equal to the minimum working pressure at the filter inlet and the same at the external pressure source. Gradually reduce the pressure at the external pressure source (simulating filter outlet pressure) until the flushing operation is performed. Repeat the test once with a filter inlet pressure, equal to the value in the middle of the Pressure range recommended by the manufacturer, and once more with a filter inlet pressure equal to the nominal pressure.

The pressure differential (the filter inlet pressure minus the external source pressure) that causes flushing shall not deviate from the pressure differential declared by the manufacturer by more than ± 10 percent.

10.2.2 *Mechanism Activated by Duration of Operation*

Pre-set the flushing control mechanism to three different time intervals – short, long and intermediate – within the range of possibilities declared by the manufacturer. Operate the filter with an inlet pressure equal to the minimum working pressure. Measure the time interval between one activation and the next one. Repeat the test with a filter inlet pressure equal to the specified pressure. The time interval between the two activations shall not deviate from the preset time intervals by more than ± 10 min.

10.2.3 *Mechanism Activated by Volume of Filtered Water*

Pre-set the flushing control mechanism to two different volumes of water within the range specified by the manufacturer. One volume is selected from the lower 20 percent of the range declared by the manufacturer and the second volume from the upper 20 percent of this range. Operate the filter and measure the volume of water flowing through the filter, up to activation of the automatic flushing control mechanism. The measured volume of water flowing through the filter shall not deviate from the pre-set quantity of water by more than ± 10 percent.

10.2.4 *Mechanism Activated by Some Other Physical Quantity*

Connect the filter to a water source and make all the adjustments necessary in accordance with the manufacturer's instructions. Maintain the pressure at the inlet to the filter at the minimum recommended working pressure. If the control mechanism is adjustable, conduct the test three times with the control mechanism pre-set differently each time to the lowest, the highest and the mid-range setting, respectively. Otherwise, conduct the test only once.

Operate the filter according to the manufacturer's instructions until three flushing cycles have been completed. Measure the value of the determining quantity at the initiation of each flushing cycle. Repeat the entire process with the pressure at the inlet of the filter readjusted to the maximum recommended working pressure. The following requirements shall be met:

- a) The flushing cycle shall be initiated and shall proceed as prescribed by the manufacturer.
- b) The value of the determining quantity at the initiation of any flushing cycle shall not deviate by more than ± 10 percent from the pre-set value for an adjustable mechanism, or from the value declared by the manufacturer for a non-adjustable mechanism.

10.2.5 *Test of Protective Device*

The filter system shall be equipped with a protective device, to prevent repeated flushing. This device shall be tested as described below:

Operate the filter with an inlet pressure equal to the minimum working pressure. Perform two consecutive manually triggered flushing. The filter shall flush satisfactorily. Continue to operate the flushing control mechanism manually triggered until the protective device stops the flushing cycle or creates, by artificial means, the conditions declared by the manufacturer which will activate the protective device. The number of flushing until activation of the protective device, or (according to type of control mechanism), the time that elapses until activation of the protective device, shall not deviate from the manufacturers declaration by more than ± 20 percent.

11 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

The manufacturer shall supply the following information about the media filter:

- a) Name and address of the manufacturer;
- b) Model and code number of filter;
- c) Material of construction and type of paint or coating;
- d) Nominal size and working pressure;
- e) Minimum and maximum working pressure;
- f) Minimum pressure required for:
  - 1) filtering operation,
  - 2) flushing operation, and
  - 3) operation of the control syste.
- g) Maximum and minimum flow-rate;
- h) Dimensions of filter;
- j) Type of connections to piping network;
- k) Length for assembly;
- m) Bed area and depth of filter;
- n) Mass
  - 1) Tank (empty vessel); and
  - 2) Tank with valves, manifolds and media.
- p) Quantity, size and type of bed;
- q) Pressure differential required to initiate flushing;
- r) Duration of flushing;
- s) Flow of flush water in the range of pressures stated by the manufacturer;
- t) Range of possibilities for flushing control according to time, volume, etc. (in case of automatic back flush filter);
- u) Number of repeat flushing (in the event of failure) until flushing stops in filters equipped with a protective mechanism (in case of automatic back flush filter);
- v) Safe maximum pressure drop and closing of cover instructions;
- w) Drawings that describe the filter and the filter battery, their parts and the manner of assembly;
- y) Quantity, size and type of filter media; and
- z) Head-loss versus flow at the recommended range chart for media defined by the manufacturer.

12 BACK FLUSHING CONTROLLER

Power supply and driving source, including instructions as to prefiltering (if water), replacement and troubleshooting. Maintenance and spare parts for the controller system.

13 MAINTENANCE

Chemical and corrosion resistance table Instructions for maintenance:

- a) Current service;
- b) Periodical - during the irrigation season including (for example) more thorough media cleaning/lubricating metal parts and rubber seals, covers, etc.;
- c) Seasonal maintenance between irrigation seasons. This should include chemical immersion of the media, checking of valve and solenoids, lubricating, etc.; and
- d) Oxidants, used for media bleaching and chemicals commonly used in agriculture, should be at the top of this table.

14 INFORMATIVE ANNEX

14.1 General

- a) A great variety of granular material is used for filtration. It is not in the scope of this standard to recommend specific media, nor its use with a water or irrigation type.
- b) However, the filter media is a decisive factor both in filtration performance as well as backwashing and maintaining the filter system.
- c) The supplier should recommend the filter media to be used and his range of media for different water quality.
- d) The supplier should relate all data to the specific filter media, such as: hydraulic, pressure and back flushing parameters, etc.

14.2 Rough Media Classification

a) Granule material — A wide range from gravel/silica/granite/sand, to anthracite and/or other organic, chemically manufactured granules, etc.

b) Specific gravity can be classified into three major categories:
   1) Most of the geological materials (2.5 - 2.75 g/cm^3);
   2) Anthracite and light material (around 1.4 g/cm^3); and
   3) Similar to water (Specific gravity of ± 1 g/cm^3).

c) Granule Shape
   1) Sharp edge shaped (crushed or occurring naturally) commonly used;
   2) Round shaped;
   3) Mixed shape; and
   4) Random shape.

d) Grain size and particle size distribution — There are complete standards defining this subject. The most common method is the U S No. size system. However, millimetric grain size is widely used.

   NOTE — If multilayer filtration is applied (which is not common nor justified in most cases in agricultural irrigation), the difference between layer granule specific gravity and size is essential in order to keep layer order after back flushing.

14.3 General Guidelines for Media Parameters to be defined by the Supplier

14.3.1 Grain size and particle size distribution The most common parameters are:

a) Effective size — The size (opening) in mm that will just pass 10 percent of the grains (10 percent by weight) [*see* IS 2405 (Part 2) and IS 10483].

b) Median size — The size in mm that half the grains will pass through (50 percent by weight) [*see* IS 2405 (Part 2) and IS 10483].

c) Uniformity Coefficient (Uc) — The uniformity coefficient (Uc) is a numeric estimate of how sand is graded, and is a dimensionless number or in other words it has no units. The term ‘graded’ relates to where the concentrations of sand particles are located by size. Sand with all the particles in two size ranges would be defined as narrowly graded sand and would have a low Uc. Sand with near equal proportions in all the fractions would be defined as widely graded sand and would have a high Uc value. The Uc is calculated by dividing D60 (the size of screen opening where 60 percent of a sample passes and 40 percent is retained) by D10 (the effective particle size- that size of screen opening where 10 percent of a sample passes and 90 percent is retained). The larger the Uc the less uniform the sand. The value of Uc which is 1.5 or less is regarded as satisfactory.

14.3.2 *Other Common Guidelines*

a) Purity — The filter media should be visually free of: clay, shale, organic material, dust and any other impurities.

b) Specific gravity should be clearly indicated. There should be a clear technological reasoning for using filter media with specific gravity of less than 2.5 g/cm^3. If applied, media escape tests should be performed with this specific media, and back flushing parameters adjusted in accordance.

c) A table, relating media size to flow rate (for different contaminants) should be presented by the supplier.

d) A general chart, relating media grade to filtration capability in microns, for various flow rates should be presented by the system supplier.

e) Chemical resistance — Should be clearly indicated. Acid solubility should not exceed 5 percent by weight.

f) Thorough cleaning of media, including chemical bath instructions, should be part of the operation manual.

g) Life expectancy of media should be declared.

h) Media replacement facilities and service should be referred to.

15 THIS STANDARD REFERS TO THREE SUPPLY PHASES OF THE FILTER

a) The filter vessel (tank) housing.

b) The filter vessel above filled with granulated media filter material(s) as a charged (filled up) filter. This configuration is complete with valves, connections, air release and / or other accessories.

c) This construction phase when connected to and controlled by a flushing control device is a complete operating single filter unit, usually positioned as a part of a filtration station called a “filter battery”. In most cases a filtered flush stream is supplied by other filter units of the battery that are in the filtering stage. In case other options are used to supply flush water, the supplier should guarantee that it is in accordance with this standard.

16 SAMPLING AND ACCEPTANCE REQUIREMENTS

16.1 Type Tests

The sample of test specimens shall be taken at random from a quantity of at least 20 filters. The number of test specimens required for each test shall be as specified in Table 3.

Table 3 Number of Test Specimens and Acceptance Number

(*Clause* 16.1)

Clause No. (1)	Name of Test (2)	No. of Test Specimens (3)	Acceptance No. (4)
6.2	Resistance of filter to internal hydrostatic pressure	3	1(1)
6.3	Resistance of filter to Internal hydrostatic Pressure at high Temperature	3	1(1)
7	Resistance to cyclic pressure	3	1(1)
8	Hydraulic parameter and tests	1	0
9.1	Test for flushing mechanism	1	0
9.2	Detecting media escape	3	1
10.2	Flushing control mechanism testing	3	1

(1) Refers only to leakage at joints. Leakage through the filter tank (vessel) is cause for rejection of the lot.

16.1.1 If the number of defective specimens in the sample does not exceed the acceptance number specified in Table 3, the sample shall be considered as complying with the requirements of this Indian Standard. If the number of defective specimens in the sample is greater than the acceptance number, the sample shall be considered as not complying with the requirements of this Indian Standard.

16.2 Acceptance Test

The test specified in **6.3** shall be only performed as part of type tests at the time of inclusion and then at every one-year frequency. The test specified in **7** shall be only performed as part of type tests at the time of inclusion and then at every three years' frequency. For acceptance of manufacturing lot or shipment of media filter, the sampling shall be conducted according to IS 2500 (Part 1) based on the AQL 2.5 and special inspection level IV. For the test specified in **6.2**, **8**, **9.1**, **9.2** and **10.2** the shipment or manufacturing lot complies with this standard if number of defective specimens found in the test does not exceed the acceptance number specified in IS 2500 (Part 1).

17 MARKING

17.1 Each filter shall be marked with the following particulars on filter housing (vessel);

a) Name of manufacturer and/or his registered trade-mark,
b) Model Identification,
c) Nominal connection size, (inlet, outlet, backflush)
d) Nominal pressure,
e) Arrow indicating the inlet and outlet,
f) Recommended flow range,
g) Type of filtration media,
h) Safety instructions, and
j) Input/output type and voltage requirements (only in case of automatic back flushing).

18 BIS CERTIFICATION MARKING

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* 6.2.3.1)

RESISTANCE OF FILTER TO INTERNAL HYDROSTATIC PRESSURE: TEST FOR PLASTIC MOULDED MATERIAL FOR FILTER HOUSING

Prepare the test specimen as per **6.2.3.1**.

A-1 PRINCIPLE

After conditioning, test pieces are subjected to a specified constant internal hydrostatic pressure for a specified period of time or until a test piece or pieces fail.

Throughout the test, the test pieces are kept in an environment at a specified constant temperature this is either water (“water-in-water” test), another liquid (“water-in-liquid” test) or air (“water-in air test).

The following test parameters shall be specified:

a) the type of end cap to be used;
b) the test temperature;
c) for evaluation purposes, the SDR or S-series or size of pipe or fitting to be used;
d) number of test pieces;
e) the test pressure, *p,* or the circumferential (hoop) stress, a, to be induced by the test pressure;
f) the type of test, that is, “water-in-water”, “water-in-liquid” or “water-in-air”;
g) the duration of the test under pressure and the criteria for a failure; and
h) the requirements, or patterns of requirements, if any which determine the initiation of additional testing.

A-2 APPARATUS

A-2.1 End Caps, fixed to the ends of the test piece. By means of an appropriate system or procedure, end caps shall allow sealing and connection to the pressurizing equipment and shall allow purging of the air before testing.

The end caps shall be one of the following types:

Type A: fittings rigidly connected to the test piece but not to each other, and hence transmitting the hydrostatic end thrust to the test piece, for example, as shown Fig. 2, or equivalent. They may comprise flanged plates on the ends of a large diameter pipes, optionally fused when flanges, caps, plugs or plates are of a compatible material to the test pieces.

Type B: sockets, made of metal, fitted with joints ensuring sealing onto the external surface of the test piece and connected to one another, and hence not transmitting the hydrostatic end thrust to the test piece. They may comprise one or more metal rods, *see* Fig. 2, allowing sufficient longitudinal movement at the ends of the test pieces, to avoid buckling due to thermal expansion. If external rods are used, contact of the outside surface of the test piece with one or several rods shall be avoided during the test. In this case, the test shall be disregarded.

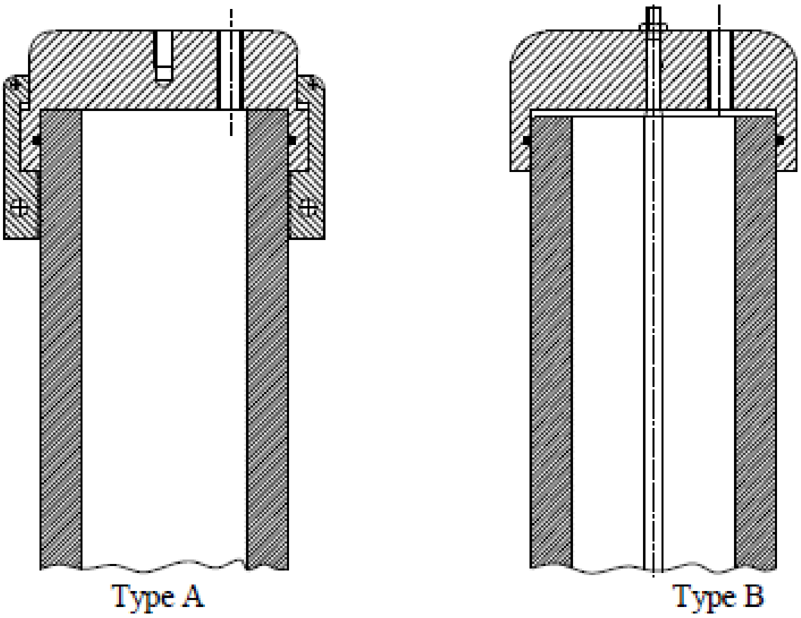

FIG. 2 EXAMPLES OF ENDS CAPS FOR INTERNAL PRESSURE TESTING

Other than toothed gripe any sharp edges which would come into contact with the outside surface of the pipe shall be rounded off. The constituent material of the end caps might have an adverse effect on the test piece under test and such materials should therefore be avoided as far as possible.

NOTE — It is recognized that times to failure can be different depending upon the type of end caps used.

A-2.2 Tank, filled with water or other liquid kept at a constant temperature as specified in the referring standard to within ± 1 °C, or oven, the temperature of which shall be kept at the specified value to within $^{+2}$– 1 °C. When an environment other than water is used, necessary precautions shall be taken, in particular those concerning safety and any interaction between liquid and the material(s) of the test piece. When environments other than water are used, tests which are intended to be comparative shall be carried out in the same environment. As the results are strongly, influenced by temperature, the tolerance on temperature should be kept as small within the specified limits for example, by using forced circulation of the fluid. When testing in all the pipe surface temperature should be checked in addition to the air. Potable water should be used and it is necessary to avoid contamination of the water by any substance likely to affect the results, for example, detergents lubricants.

A-2.3 Support or hangers, enabling test pieces to be pieces in the tank or oven such that contact between them of with the sidewalls of the tank/oven is avoided as far as possible so as not to influence the test results.

A-2.4 Pressurizing equipment: capable of applying the required pressure gradually and smoothly and then of keeping this indicated (or measured) pressure to within $^{+2}$– 1 percent for the duration of the test. As the results are strongly influenced by pressure, the tolerance on pressure should be kept as small as possible within the specified limits. The pressure should preferably be applied individually to each test piece. However, the use of equipment enabling the pressure to be applied simultaneously to several test pieces is also permitted if there, is no danger of interference when failure occurs (for example, by the use of an isolation valve or a test based on the first failure in a batch). To maintain the pressure within the specified tolerance, a system should be introduced which automatically controls the pressure within this specified tolerance (for example, due to expansion of the test piece).

A-2.5 Pressure measurement devices, capable of checking conformity to the specified test pressure. The range of the gauge shall be such that the required pressure setting shall lie within the calibrated range of the device used (*see* **A-4**). The pressure measurement devices shall not contaminate the test fluid. In case of dispute, the reference level of the pressure device shall be equal to the water level in the tank. Master gauges for calibration of the apparatus should be used. It is recommended to use equipment which is capable of stopping the timer (**A-2.7**) in event of failure or leakage and closing the pressure circuit to the test piece concerned.

A-2.6 Temperature measuring equipment, capable of checking conformity to the specified test temperature (*see* **A 2.2**).

A-2.7 Timer, capable of recording the duration of the pressure applications up to the moment of failure or leakage, to within 0.5 percent of the expected testing time.

A-3 NUMBER OF TEST PIECES

Prepare a minimum of three test pieces unless otherwise specified in the referring standard or specification.

A-4 CALCULATION OF TEST PRESSURE

A-4.1 General

For material testing, the test pressure shall be calculated from a given circumferential hoop stress and based on the measured dimensions of the test piece, *see* **A-4.2**.

For pipe testing, the pressure shall be calculated from a given circumferential hoop stress and using one of the following options/given by the referring standard or specification:

a) Based on the measured dimensions of the test piece, *see* **A-4.2**; and
b) Based on the nominal dimensions of the test piece, *see* **A-4.3**.

For testing of components, the test pressure shall be as given in the referring standard. For testing of assemblies, the test pressure shall be calculated from a given circumferential hoop stress and based on the SDR of the pipe(s) used for the test piece, *see* **A-4.4**, unless a test pressure is specified by the referring standard or specification.

A-4.2 Pressure calculations based on the measured dimensions of the test piece:

a) Calculate the test pressure, p, in kg/cm^2 ; and
b) to three significant figures, using the following equation:

$$P = 10.2\,\sigma\,\frac{2\,e\,min}{d\,em - e\,min}$$

where

σ = is the hoop stress to be induced by the applied pressure, in megapascals d_{em}
dem = is the mean outside diameter of the test piece, in millimetres
e min = is the minimum wall thickness of the free length of the test piece, millimetres

NOTE: The factor 10.2 results from the ratio between megapascals and kg/cm^2.

A.4.3 Pressure calculations based on the nominal dimensions of the test piece

1) Calculate the test pressure, p, in kg/cm^2
2) to three significant figures, using the following equation:

$$P = 10.2\,\sigma \frac{2\,e\,n}{d\,n - e\,n}$$

where

σ = is the hoop stress to be induced by the applied pressure, in megapascals $d_{em;}$

dn = is the mean outside diameter of the test piece, in millimetres; and

en = is the minimum wall thickness of the free length of the test piece, millimetres.

NOTE — The factor 10.2 results from the ratio between megapascals and kg/cm^2.

A-4.4 Pressure Calculations Based on SDR of Pipe(s) of the Test Piece

a) Calculate the test pressure, p, in kg/cm^2 ; and
b) to three significant figures, using the following equation:

$$P \frac{2\,(10.2\,\sigma)}{[SDR] - 1}$$

where

σ = is the hoop stress to be induced by the applied pressure, in megapascals d_{em}; and

SDR = is the standard dimension ratio of the pipe(s) of the test piece.

NOTE — The factor 10.2 results from the ratio between megapascals and kg/cm^2.

A-5 CALIBRATION AND ACCURACY OF THE APPARATUS

The temperature and pressure control systems and the equipment for measuring temperature, pressure and time shall be capable of maintaining the values within the specified limits and shall be calibrated. The accuracy of the apparatus shall be considered such that the requirements for temperature, pressure and time are fulfilled.

A-6 CONDITIONING

Prepare the test pieces, removing any traces of dirt, oil, wax or other contamination, and fit them with the end caps (**A.2**) specified for the test. Measure and record the free length of the pipes of the test piece l0, as appropriate. Fill the test pieces with water, which may be preheated to a temperature not more than the test temperature. After filling the test pieces, immerse them in a water bath or place them in an oven at the temperature specified by the referring standard and condition for a period in accordance with Table 4. When conditioning at temperatures in excess of 100 ºC sufficient pressure shall be applied to prevent boiling.

Table 4 Conditioning Periods

(*Clause* A-6)

Thickness e_{min}, mm	Minimum conditioning period h
$e_{min} < 3$	1
3 ≤ *e*min < 8	3
$8 \le e_{min} < 16$	6
$16 \le e_{min} < 32$	10
32 ≤ *e*min	16

NOTE — It is recognized that extended conditioning periods beyond those specified in Table 4 could influence the test results.

The test pieces shall not be tested within the period of time after their manufacture specified in the referring standard. Otherwise, a minimum period of 24 h after production shall be observed.

A-7 TEST PROCEDURE

A-7.1 Select the type of test, that is, “water-in-water”, “water-in-air”, or “water-in-liquid”, as specified by the referring standard or specification. Measure and record the time taken to pressurize the test piece as follows. Connect the test pieces to the pressurizing equipment (**A-2.4**) and bleed off the air. After conditioning, progressively and smoothly apply the test pressure as calculated in **A-4**, in the shortest time practicable between 30 s and 1 h depending upon the material, the size of the test piece and the capability of the pressurizing equipment.

When the test pressure is achieved, record the time or reset the timer as necessary to begin to measure the period for which the specified pressure is maintained in the test piece(s).

A-7.2 Keep the test piece suspended in the thermally controlled environment. Maintain a constant temperature as mentioned in **Table 2** of clause **6.2.3.1** and observe the temperature tolerances specified in **A-2.2** until testing ceases in accordance with **A-7.3** or **A-7.4** as applicable.

A-7.3 The test is terminated either when the specified duration as mentioned in **Table 2** of **6.2.3.1** is reached, or when a failure or leak occurs in the test piece, in which case record the time to failure, unless the procedure given in **A.7.4** is applicable.

If a failure occurs, record the type, that is, brittle, or ductile, or other.

NOTE — Failure is “brittle” if no visible yield deformation has occurred in the failure zone. If the failure is accompanied by a yield deformation in the failure zone, visible without magnification, it is of the “ductile” type. For some materials, brittle failure could be indicated by weeping at the pipe surface.

In the event of equipment failure, tests which have been ongoing for a period of 500 h to 1 000 h may be continued providing the equipment is reinstated within one day. For tests which have been ongoing for a period of more than 1 000 h, the test may be continued, provided the equipment is reinstated within three days. The time during which the equipment is not able to function normally shall not be included in the test time. Test interruptions shall be recorded in the test report.

A-7.4 If a break occurs in the test piece at a distance of less than 0.1 l0 mm from an end cap, disregard the result and repeat the test using another test piece.

When testing components, if there is a leakage outside of the component itself (failure of the seal or bursting of the pipe), or any failure associated with grooves machined and indicative of inappropriate groove design and/or machining conditions, repeat the test – if necessary using other components – such that the assembly remains watertight for the minimum period required for the test.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Farm Irrigation and Drainage Systems, FAD 17

Organization	*Representative(s)*
National Institute of Biotic Stress Management, Raipur	Dr S. K. Ambast (***Chairman***)
Automat Industries Private Limited, New Delhi	Shri Dinesh Kumar Shri Durga Pada Ghosh (*Alternate*)
Chaudhary Charan Singh Haryana Agricultural University, Hisar	Dr Vijaya Rani
Central Institute of Petrochemicals Engineering and Technology (CIPET), Chennai	Shri S. K. Jain Dr A. K. Nema (*Alternate*)
EPC Industries Private Limited, Nashik	Shri Sankar Kumar Maiti Shri C. V. Joshi (*Alternate*)
Finolex Industries Limited, Pune	Shri Vijay Jadav Shri Bajirao Bhosale (*Alternate*)
Gas Authority of India Ltd. (GAIL), New Delhi	Shri Manish Khandelwal
Gujarat Green Revolution Company Limited, Vadodara	Shri P. P. Donga Shri R. V. Limbashia (*Alternate*)
ICAR-Central Institute of Agricultural Engineering, Bhopal	Dr Ramdhar Singh
Indian Council of Agricultural Research, New Delhi	Dr K. V. Ramanarao
Indian Institute of Technology Kharagpur, Kharagpur	Dr Ashok Mishra Shri Chandranath Chatterjee (*Alternate*)
Jain Irrigation Systems Limited, Jalgaon	Shri Sunil Lodha Shri Abhijit Joshi (*Alternate*)
National Committee on Plasticulture Applications in Horticulture, New Delhi	Shri Anand Zambre Shri Rohit Lall (*Alternate*)
National Productivity Council, New Delhi	Shri N. K. Chanji Shrimati Rachana Shalini (*Alternate*)
Netafim Irrigation Private Limited, Vadodara	Shri S. Sethuramalingam Shri Govind Tapadia (*Alternate*)
Nimbus Pipes Limited, Jaipur	Shri Ashish Kumar Lath Shri Er Atit Soni (*Alternate* I) Shri B. L. Jangid (*Alternate* II)
Orange Growers Association of India, Amravati	Shri Amol Mohanrao Totey
Premier Irrigation Adritec Limited, Nagpur	Shri P. K. Basak Shri G. K. Kumar (*Alternate*)
Punjab Agricultural University, Ludhiana	Dr K. G. Singh
Reliance Industries Limited, Mumbai	Shri Saurabh Bagal Shri Amit Shah (*Alternate*)

Organization	*Representative(s)*
Saurashtra Plastics Manufacturer's Association, Rajkot	Shri Arun Rokad Shri J. K. Patel (*Alternate* I) Shri Bharat Kumar V. Siroya (*Alternate* II)
Visvesvaraya Technological University (VTU), Belgaum	Dr Nagraj S. Patil Shri Vijay Kumar H. (*Alternate*)
In Personal Capacity	Dr T. B. S. Rajput
BIS Directorate General	Shrimati Suneeti Toteja, Scientist 'E' and Head (FAD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Pawan Kumar
Scientist 'C' (FAD), BIS

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